

1. General description

Planar passivated four quadrant triac in a SOT78 (T0-220AB) plastic package intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance.

2. Features and benefits

- High blocking voltage capability
- High noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants

3. Applications

- General purpose motor controls
- General purpose switching

4. Quick reference data

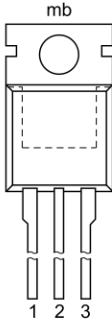
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	400	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 91\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	-	25	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	-	190	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$	-	-	230	A
T_j	junction temperature		-	-	125	°C
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7	-	6	50	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7	-	10	50	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7	-	11	50	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7	-	23	75	mA
I_H	holding current	$V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; T2+; Fig. 9	-	7	30	mA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
		$V_D = 12\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$; T2-; Fig. 9		-	12	30	mA
V_T	on-state voltage	$I_T = 30\text{ A}$; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 10		-	1.3	1.55	V
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 268\text{ V}$; $T_j = 125\text{ }^{\circ}\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit		100	300	-	V/ μ s
dV_{com}/dt	rate of change of commutating voltage	$V_D = 400\text{ V}$; $T_j = 95\text{ }^{\circ}\text{C}$; $dI_{com}/dt = 9\text{ A/ms}$; $I_T = 25\text{ A}$; gate open circuit		-	10	-	V/ μ s

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	 TO-220AB (SOT78)	 sym051
2	T2	main terminal 2		
3	G	gate		
mb	T2	mounting base; main terminal 2		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
MAC223A6	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	400	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 91\text{ }^{\circ}\text{C}$; Fig. 1; Fig. 2; Fig. 3	-	25	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig. 4; Fig. 5	-	190	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 16.7\text{ ms}$	-	230	A
I^2t	I^2t for fusing	$t_{\text{p}} = 10\text{ ms}$; SIN	-	180	A^2s
di_{T}/dt	rate of rise of on-state current	$I_{\text{G}} = 200\text{ mA}$; T2+ G+	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 200\text{ mA}$; T2+ G-	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 200\text{ mA}$; T2- G-	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 200\text{ mA}$; T2- G+	-	10	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current		-	2	A
P_{GM}	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
T_{stg}	storage temperature		-40	150	$^{\circ}\text{C}$
T_{j}	junction temperature		-	125	$^{\circ}\text{C}$

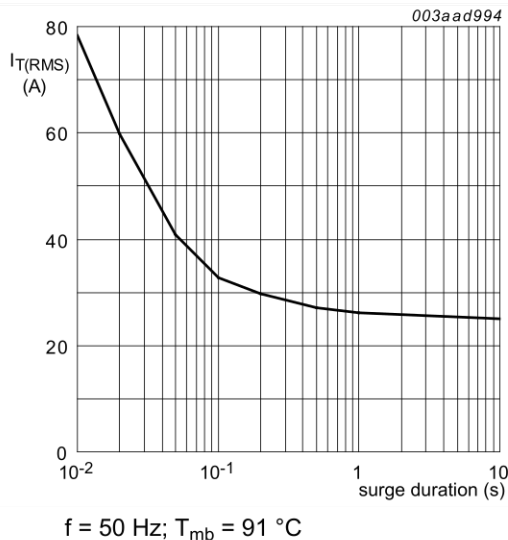


Fig. 1. RMS on-state current as a function of surge duration; maximum values

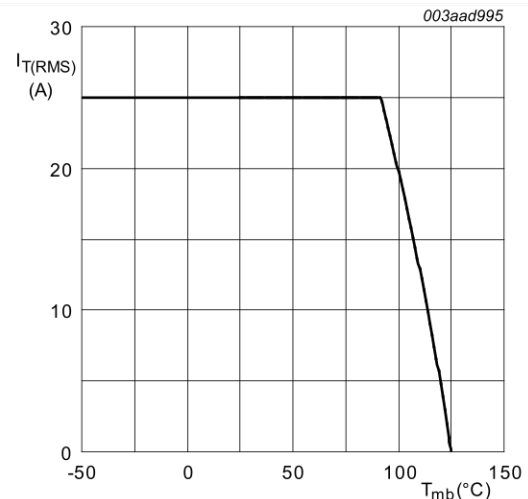
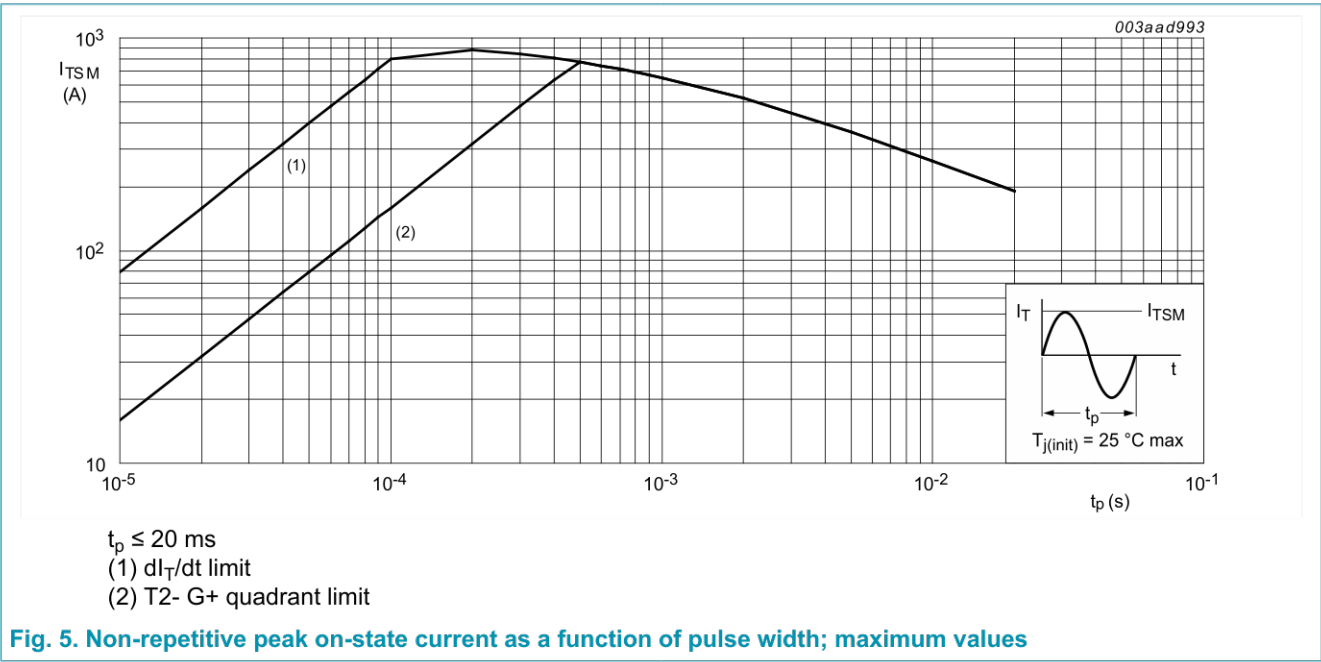


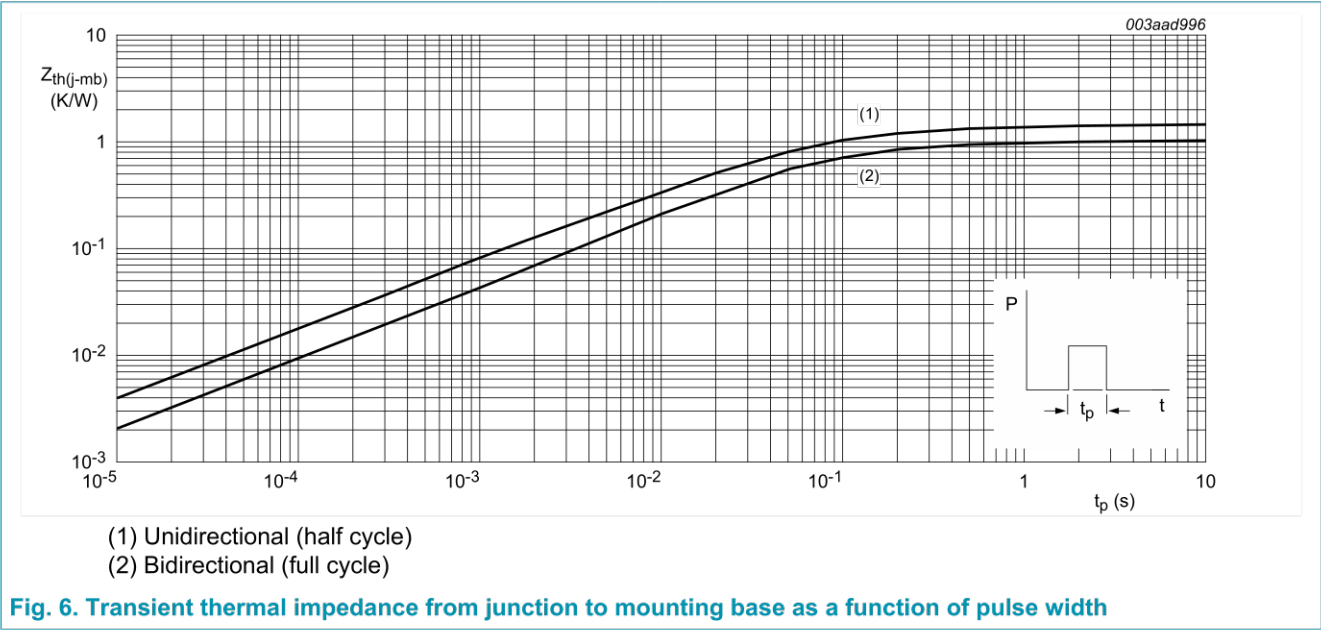
Fig. 2. RMS on-state current as a function of mounting base temperature; maximum values



8. Thermal characteristics

Table 5. Thermal characteristics

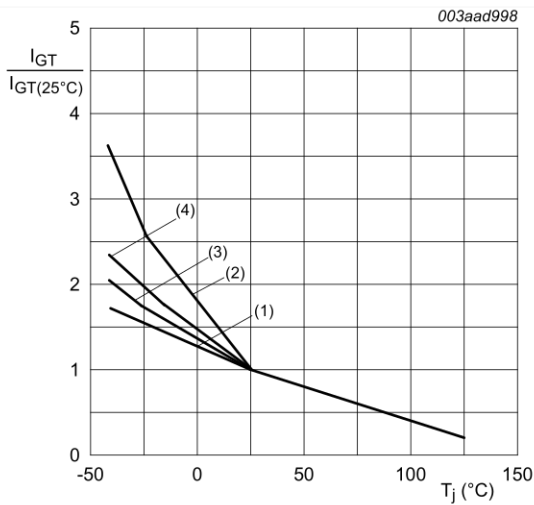
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; Fig. 6		-	-	1	K/W
		half cycle; Fig. 6		-	-	1.4	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	60	-	K/W



9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7		-	6	50	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7		-	10	50	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7		-	11	50	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7		-	23	75	mA
I_L	latching current	$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 8		-	8	40	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 8		-	30	60	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 8		-	18	40	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 8		-	15	60	mA
I_H	holding current	$V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; T2+; Fig. 9		-	7	30	mA
		$V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; T2-; Fig. 9		-	12	30	mA
V_T	on-state voltage	$I_T = 30\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10		-	1.3	1.55	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11		-	0.7	1	V
		$V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ °C}$; Fig. 11		0.25	0.4	-	V
I_D	off-state current	$V_D = 400\text{ V}$; $T_j = 125\text{ °C}$		-	0.1	0.5	mA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 268\text{ V}$; $T_j = 125\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit		100	300	-	V/ μ s
dV_{com}/dt	rate of change of commutating voltage	$V_D = 400\text{ V}$; $T_j = 95\text{ °C}$; $dI_{com}/dt = 9\text{ A/ms}$; $I_T = 25\text{ A}$; gate open circuit		-	10	-	V/ μ s
t_{gt}	gate-controlled turn-on time	$I_{TM} = 30\text{ A}$; $V_D = 400\text{ V}$; $I_G = 0.1\text{ A}$; $dI_G/dt = 5\text{ A}/\mu\text{s}$		-	2	-	μ s



- (1) T2+ G+
- (2) T2+ G-
- (3) T2- G-
- (4) T2- G+

Fig. 7. Normalized gate trigger current as a function of junction temperature

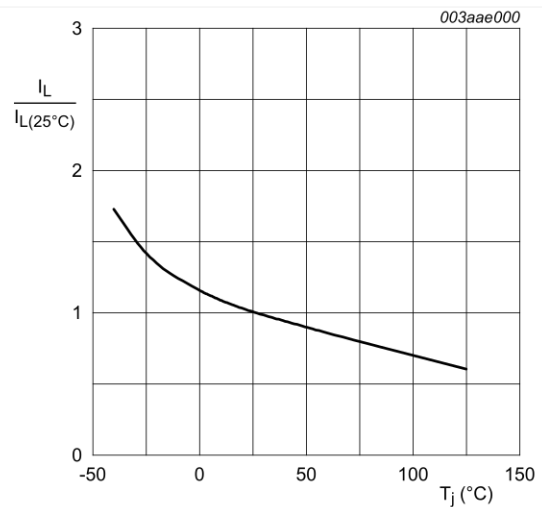


Fig. 8. Normalized latching current as a function of junction temperature

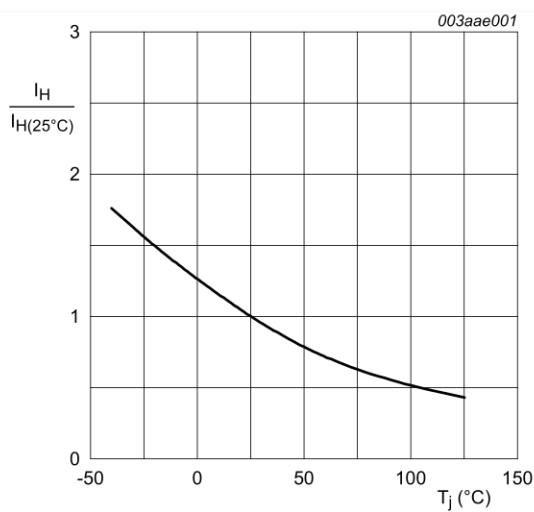
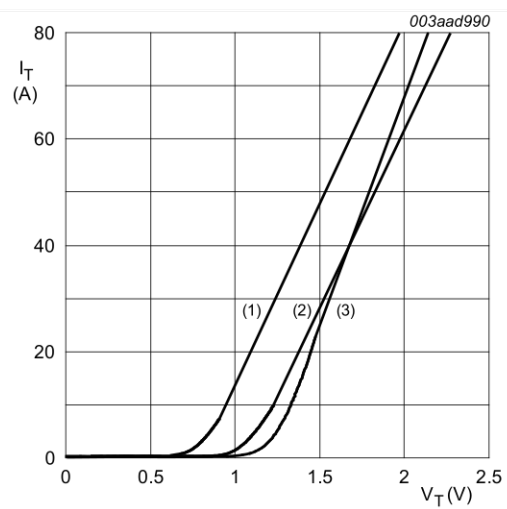


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.073 \text{ V}$; $R_s = 0.015 \Omega$

(1) $T_j = 125^\circ\text{C}$; typical values

(2) $T_j = 125^\circ\text{C}$; maximum values

(3) $T_j = 25^\circ\text{C}$; maximum values

Fig. 10. On-state current as a function of on-state voltage

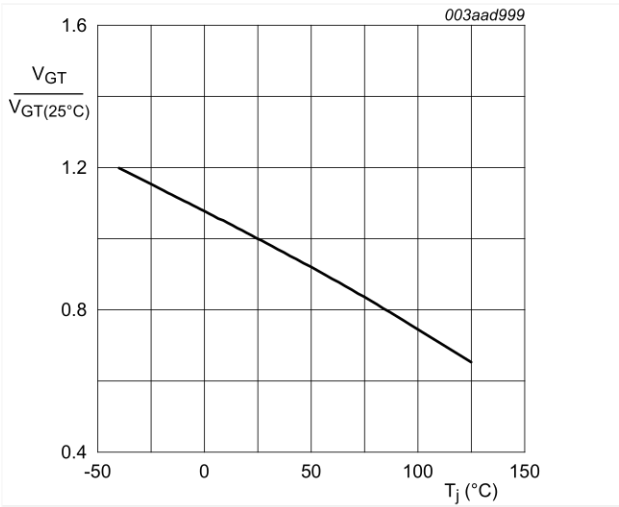


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

10. Package outline

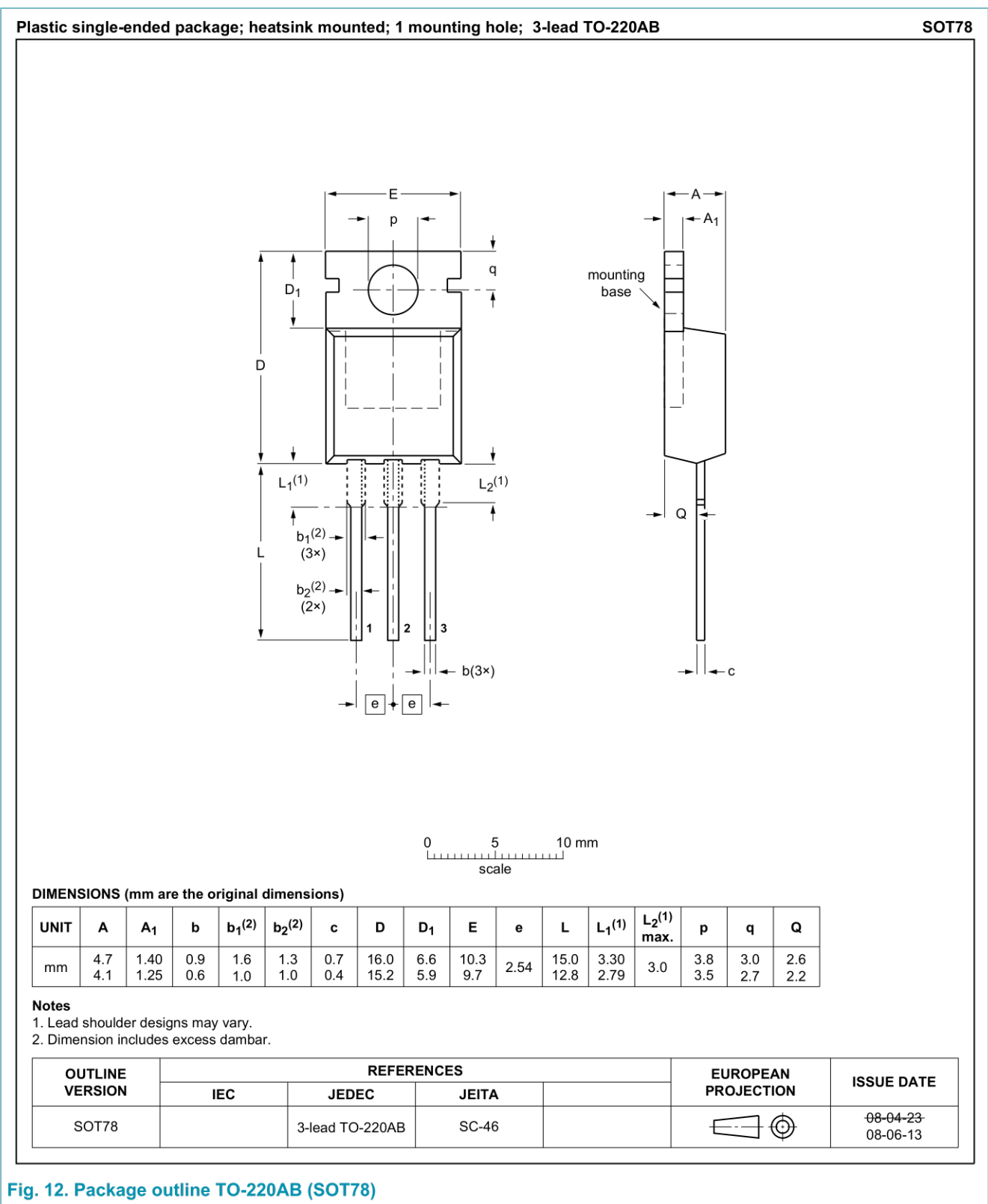


Fig. 12. Package outline TO-220AB (SOT78)

11. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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- [2] The term 'short data sheet' is explained in section "Definitions".
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